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A Study to Determine if Participating in Technology Education Classes Improved the Mechanical Aptitude of Students

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**A STUDY TO DETERMINE IF PARTICIPATING IN TECHNOLOGY
EDUCATION CLASSES IMPROVED THE MECHANICAL APTITUDE OF
STUDENTS**

A Research Paper

Presented to

**The Faculty of the Department of
Occupational and Technical Studies
Old Dominion University**

In Partial Fulfillment

Of the Requirements for the Degree

Masters of Science

In Occupation and Technical Studies

By

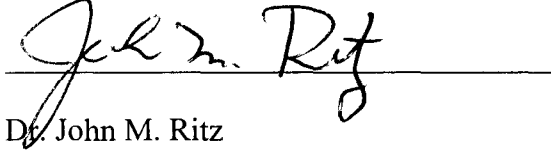
Amos C. Peterson

December 2000

SIGNATURE PAGE

Amos C. Peterson prepared this research paper under the direction of Dr. John M. Ritz in OTED 636, Problems in Occupational and Technical Studies. It was submitted to Dr. John M. Ritz, Research Advisor and Graduate Program Director, as partial fulfillment of the requirements for the Master of Science in Occupational and Technical Studies Degree.

APPROVED BY:

A handwritten signature in cursive script, reading "John M. Ritz", is written over a horizontal line.

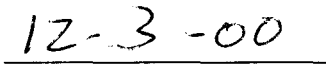
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A handwritten date "12-3-00" is written over a horizontal line.

ACKNOWLEDGEMENTS

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Amos C. Peterson

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CHAPTER I

INTRODUCTION

Technology and its use has had a strong influence on the way humans interact with their environment on a daily basis. It has allowed our society to make major advances in communication, transportation, agriculture, manufacturing, construction and many other technological aspects of our lives. Our use of technology has significantly improved our living conditions, made travel more convenient, made information more available to the greater population, and simplified our communication systems to enable faster access throughout the World.

A study of technology education conducted by Perry (1992) discussed the important role technology played in extending the human intellect and stimulating the creativity in American youths. He relates, “as the future approaches, students within our educational system need to become more technologically literate, able to understand and act upon changes within society and efficiently enter the work force” (Perry, 1992, p. 1).

As a future Technology Education Teacher, the idea of potentially increasing students’ mechanical aptitude through the application of technology was fascinating to this researcher. Identifying a tool for **testing the validity and quality of technology education** delivered in middle schools was especially important to this researcher, since there is no current tool used by the school system for measuring the “**outcome of technology education.**” Occupational and organizational psychologists Allan, Birbi and Warr (1999) maintained “there is a widespread need to improve **the evaluation of**

training in order to achieve a greater return on our investment.” These are issues that helped to define the problem of this study.

STATEMENT OF THE PROBLEM

The problem of this study was to determine if participating in technology education classes improved the mechanical aptitude of middle school students.

HYPOTHESIS

The following hypothesis was set forth to guide this study:

H₁: Students taking technology education classes at Northside Middle School developed higher levels of mechanical aptitude when compared to students from the same school that took only the traditional general education classes.

BACKGROUND AND SIGNIFICANCE

School systems have worked harder at developing and employing technology education methods, in hopes of increasing their students' general aptitude. Today's job market demands workers with increased technological skills. Workers are now required to have experience in the operation of computer systems, including multi-media navigation, graphics, word processing and Web-based program manipulation. Office or industrial machinery continued to evolve technologically, providing capabilities such as instant communication around the world, multi-tasking, increased automation and robotics. The study and application of technology education could be used to increase the mechanical aptitude of students and also enhance their abilities to excel at general

studies. The concepts, principles and skills learned through problem solving, design and hand-on experience during technology education classes prepared our students for greater success in our technologically advanced society.

As workers of the future, it is important that today's children learn the technological concepts/theories, practice applying those theories/concepts and become familiar with technological advances in every area. The proper instruction of Technology Education should help increase the mechanical aptitude of students and also increase their readiness for today's technologically advanced careers. Skills learned in the application of technology education should ensure smoother student transition from school to the work force. The ability to test the quality of skills obtained thereof should be important to educators. Mechanical aptitude tests are currently used by school counselors as tools for making valid predictions of students' potential for employment in a particular work environment.

Although there have been an abundance of literature documenting the use of technology education to increase aptitude, there appeared to be a lack of studies however, documenting to what degree technology education affects mechanical aptitude of students. There have been many acceptable aptitude/intelligence/performance tests employed by the public school systems to measure the outcome of general education. Given the important role technology education can play in the public school system, this researcher believed there was no current acceptable method of measuring the effectiveness or quality of technology education being taught in middle schools today.

This researcher believed there was a great need for measuring the outcome of technology education in the public school system, in order to determine its task validity,

or determine if the curriculum is doing the job it is supposed to do. In order to accomplish this, a valid testing instrument must be employed for use throughout the school system. This instrument must be practical, must use up to date information, must apply to both genders equally, and must be applicable across the cultural or sub-grouping boundary. The Wiesen Test of Mechanical Aptitude fits the criteria for this testing, even though it had not been used on subjects younger than eighteen years of age. Gaining positive results from this test could mean the educational content, presentation and application were adequate, and the time/money spent in this area were well justified. This study investigated the above problem and helped answer questions about the relationship between teaching technology education and its ability to increase mechanical aptitude of students.

According to Wiesen (1999), “mechanical aptitude is important for many jobs and tests of mechanical aptitude are widely used to help select employees”. Wiesen (1999) also maintained that a literature review revealed *no evidence* that refuted mechanical aptitude tests as *being invalid* for selecting personnel for specific jobs. In other words, mechanical aptitude tests are acceptable and appropriate tools for predicting potential for employment. There have been many tests used to measure mechanical aptitude, most of which are sponsored by the Psychological Corporation. Favorable results from the Wiesen Test of Mechanical Aptitude (WTMA) justified to others the significance of teaching technology and the need for increased administrative support for continued growth in this area of instruction.

LIMITATIONS

Limitations of this study included the following:

1. The only medium used for determining mechanical aptitude for this study was the Wiesen Test of Mechanical Aptitude.
2. The study was conducted during the Spring of 2000.
3. Only fifty students from each experimental and control group were sampled.
4. This study was conducted on sixth, seventh and eight grade students at Northside Middle School in Norfolk, Virginia.
5. There is a lack of published information determining the relationship between taking technology education classes and its effect on learner's abilities.
6. The Wiesen Test of Mechanical Aptitude was designed to test individuals from age eighteen and above only.

ASSUMPTIONS

The following assumptions were made concerning the conditions and participants in this research study:

1. The experimental group of the study had been enrolled in Technology Education classes for at least a six-month period, and the control group had not been exposed to technology education classes.
2. The method used to determine mechanical aptitude for students in this study has been properly researched and validated.
3. Technology education in middle schools differs in concept, content, quality and application from school to school.

4. Technology education will ensure students are able to address future technological issues and problems.
5. The study of technology education emphasizes the relationship between science and technology, and the impact they have had on our society and the environment.
6. Mechanical aptitude includes a person's ability to learn/interact in the following manner: reason mechanically, be familiar with physical objects or tools, understand concepts of size/shape/weight /appearance, understand the function of tools/devices/objects, and understand how tools/machinery/devices are repaired or maintained.

PROCEDURE

The subjects of this study were sixth, seventh and eight grade students enrolled in education classes at Northside Middle School, Norfolk, Virginia. An experimental group of 50 students enrolled in technology education classes were compared to fifty students from the same population attending general education classes, but not enrolled in any technology education classes. Permission was obtained to conduct the study at Northside Middle School System. The instrument used for the study was the Wiesen Test of Mechanical Aptitude developed by Joel P. Wiesen, in the form of sixty multiple-choice questions taken in a thirty-minute period. The responses obtained from the test were compiled and tabulated to determine whether the goals of this study were effectively addressed. Findings of this study were then analyzed and summarized before conclusions and recommendations were reported.

DEFINITION OF TERMS

Use of the following terms were employed throughout this study:

1. WTMA - Wiesen Test of Mechanical Aptitude.
2. Mechanical Aptitude - The ability of a person to learn about mechanical objects and mechanical principles in an implicit and explicit manner. It demonstrates a person's degree of familiarity with common tools/devices, in relation to their use, shape, size, weight, repair, appearance and function (Wiesen, 1999. p. 2).
3. ODU - Old Dominion University.
4. NMS - Northside Middle School.
5. Technology – A general term used to describe the process by which human beings manipulate tools and machines to increase their control and understanding of the material environment (Microsoft Encarta, 2000).
6. Technology Education - The study and application of modern methods of transportation, manufacturing, construction and communication systems resources and/or outcome, as they apply to society, individuals and the environment (Ritz, 1992, p. 4).
7. OTS - Occupation and Technical Studies at Old Dominion University.

OVERVIEW OF CHAPTERS

Chapter I focused on the problem of correlation between technology education and mechanical aptitude. The research problem was to determine if participating in technology education classes improved the mechanical aptitude of students at Northside Middle School in Norfolk, Virginia. A hypothesis was established, reasons for studying

this problem were discussed, and background information was stated. This chapter included assumptions and limitations of the study and also included definitions of terms used throughout the study.

Chapter II focused on examining the literature related to this study. It identified research conducted on technology education and mechanical aptitude and also identified the need to conduct further research about measurement of mechanical aptitude and students' grasp of technology education. Variables were identified, relationships were determined and the significance of the problem was revealed. Chapter III contained a discussion on the procedures and methods of application of the goals. The sampling techniques were listed and concerns of reliability/validity of the study were determined.

Chapter IV contained a discussion and analysis of the study's findings. The data were summarized, analyzed and arranged in a figure and tables. Chapter V contained a summary of the first four chapters. It also contained conclusions reached and recommendations for further study. Finally, the initial hypothesis was analyzed to determine if the requirements were met and speculation was made about what the researcher could have done differently to improve the study results.

CHAPTER II

REVIEW OF LITERATURE

This chapter contained a review of literature. The discussion focused on the relationship between taking technology education classes in middle school and its ability to increase the mechanical aptitude of students. The variables of defining current criteria used for teaching technology education classes in middle school, current use and methods of measuring mechanical aptitude for school children, and the potential to increase mechanical aptitude of students taking technology education classes were discussed in this chapter.

TECHNOLOGY EDUCATION IN MIDDLE SCHOOLS

According to the International Technology Education Association (2000), the technology education curriculum should include open-ended problem-based learning activities, using math/science/technological principles to solve these problems. Students are afforded the opportunity to understand the nature of technology and its relationship with other fields of study, to understand the influence and effects technology has on our environment, society, culture, economics, politics, and history. Students are also able to develop an understanding of: engineering design, the process of research and development, the differences between invention and innovation, the concept of troubleshooting, the value of experimentation, all of which can be used as methods of problem solving.

The International Technology Education Association (2000) delineated standards and content areas of learning for middle school students. These included: medical, agriculture, energy and power, information and communication, transportation, manufacturing and construction technologies. The learning standards of students would include developing skills for determining how to apply design principles, how to use and maintain systems/products, and how to calculate what impact these products/systems have on our society. The Virginia Technological Systems Instructional Resource Guide (1990, p. iii) stated that the “technology education program at the middle school level is designed to provide the early adolescent with learning situations and higher-order thinking skills development and the processes of problem solving and creating.”

A short history of technology education at this point would help the reader to understand its societal significance. Technology education originated from industrial arts education, formerly taught in the public school systems as a portion of general education. Industrial arts classes were designed to prepare students with practical experiences, personal development, career guidance and basic preparation for many careers and jobs. According to Ritz (1991), technology education moved from the old emphasis on drafting, woodworking, metalworking, etc., to applying and studying technological systems, including communication, transportation, manufacturing and construction.

In March 1990, during the National Governor’s Association meeting, state leaders enacted a goal of making schools in the United States second to none. They declared:

All workers will have the opportunity to acquire the knowledge and skills needed to adapt to constantly emerging new technologies, new work methods, and new

markets through public and private vocational, technical workplace, or other innovative programs (Education Week, 1990, p.16).

In Virginia's Technological Systems guide, Davis (1990, p. iii) said "today's schools must prepare students to understand technological innovation, productivity of technology, impact of technology on the quality of life, and the need for critical evaluations of the social changes resulting from technological improvements". Other studies suggesting a need to study the impact of technology included the Rand Report. It suggested "the nation's most important educational goal must be to produce learners adequately prepared for life and work in the 21st century, learn how to gather information, collaborate with others in the use of that information in solving problems and making informed judgments" (Glennan & Melmed, 1996, p. 1).

Technology education plays an important role in our school system and its need is frequently voiced by our national leaders. In 1994, President Clinton, Vice President Gore, and Secretary of Education Riley made a goal to have all schools connected to the national information infrastructure (NII) by the year 2000. New federal legislation, including Goals 2000: Educate America Act and the Improving America's Schools Act (IASA), gave the study of technology a prominent position in general education. The Department of Education (DoED) prepared a national plan to promote the use of educational technology, including financial support to all state school systems. These are more reasons for measuring the outcome of technology education in the school system and validating a suitable instrument of measurement.

POTENTIAL BENEFITS OF TECHNOLOGY EDUCATION

Technology education is an important component of public education policy.

The incentives inherent in a competitive marketplace that have driven the restructuring of business are largely missing in public elementary and secondary education. Because of these differences in incentives and because, in most instances, elementary and secondary education is provided by the state, explicit public actions are required to more fully realize the potential benefits of technology education (Glennan & Melmed, 1996).

Studies conducted on a variety of specific applications of technology education show improvements in student performance, student motivation, teacher satisfaction, and other important educational outcomes, according to Glennan & Mellmed (1996). They also maintained that solid evidence exists showing instructional activities making intensive use of technology can lead to significant improvements in student achievements. The success of any educational program however depends upon the quality of programs implemented. In order to discover “potential benefits” of technology education in our schools, research must be undertaken to determine the performance or success of technology education classes and their potential to increase the aptitude of students taking these programs.

MECHANICAL APTITUDE TESTING

Tests of mechanical aptitude were primarily used to predict job effectiveness or determine the employability of personnel in a particular occupation. Some of the more popular tests included: the Differential Aptitude Test developed by Bennett, Seashore and

Wesman (1974), the Bennett Mechanical Comprehension Test in (1940), the Aptitude Interests Inventory developed by Educational Technologies, Inc. (1993), and the Armed Services Vocational Aptitude Battery developed by the Department of Defense in 1968.

Looking at the problem of testing, there are important barriers to obtaining defensible, research-based information on the performance of technology education delivery in our schools. First, many of the currently available tests did not reliably measure the outcomes that were being sought by advocates of technology based school programs. Most reported measures had been obtained from traditional multiple-choice tests. “Assessments of the impact of technology were really assessments of instructional processes enabled by technology, and the outcomes were highly dependent on the quality of the implementation of the entire instructional process (Glennan & Melmed, 1996). According to Wiesen (1999), traditional ways of assessing the effectiveness of educational programs such as the Iowa, California or Stanford tests were generally inefficient for assessing the contribution of technology. Most of the major existing tests have: “dated content (50 years old), highly academic test content, gender/culture limited questions, little correspondence to the definition of mechanical aptitude, and require higher level reading skills” (Wiesen, 1999).

In an effort to address these issues, the Wiesen Test of Mechanical Aptitude was developed (1997/1999). It is a modern aptitude test designed to use common objects/events, minimize gender and racial/ethnic biases, deliver modern day test content, while providing a standard for conducting more academic research on mechanical aptitude (Wiesen, 1999). According to Wiesen (1999), “Mechanical aptitude is measured

by the degree of familiarity with everyday physical objects, tools, and devices, especially their function, use, repair, size, shape, weight and appearance”.

The Wiesen Test of Mechanical Aptitude is a relatively short test that only takes 20 to 30 minutes for completion. A student only needs to have a sixth grade reading ability to take the test. It covers eight broad classes of mechanical principles and three kinds of objects. These include basic machines, basic electricity and electronics, gravity concepts, movement of objects, methods of heat transfer, properties of matter/materials, some academic content and some miscellaneous content. The objects primarily used in the test were from the kitchen, household in general and other common or daily used objects.

The test itself is easy to administer to individuals or groups, the instructions are fairly easy to follow and it is easily scored upon completion. Although the test was oriented more towards students 18 years and older, this researcher believed the Wiesen Test of mechanical aptitude would prove to be a valid tool for measuring mechanical aptitude of middle school students. Although the Wiesen Test for Mechanical Aptitude can be used for personnel selection for particular job areas, the test booklet does not mention it being used as a measure of “increased” mechanical aptitude.

SUMMARY

Chapter II focused on examining the literature related to this study. It identified research that had been done in this area and explored the variables of technology education for middle schools and mechanical aptitude testing. Their relationship was examined and the significance of the problem was revealed. Although there is enough research acknowledging “taking technology education classes” has resulted in significant

increases in student achievement, performance and guidance for occupational assessment, there was no available research crediting technology education with increasing mechanical aptitude. This researcher concludes that more research needs to be accomplished in this area.

CHAPTER III

METHODS AND PROCEDURES

This chapter contained a discussion of the methods and procedures for collection of data for the study. The method used was experimental research, using a control group and an experimental group of students. The topics used for developing this chapter were population, research variables, instrument design, methods of data collection and summary.

POPULATION

The population of the experimental group was composed of a total combination of fifty students from the sixth and seventh grades who were enrolled in technology education classes at Northside Middle School. The population of the control group of this study was compiled from a combination of fifty students from the sixth and seventh grades at the same school, which had not taken technology education. A concentrated effort was made to ensure that in fact the control group **had not been exposed** to technology education.

RESEARCH VARIABLES

According to the review of literature, the following research variables were identified: the dependent variable was identified as “**mechanical aptitude**,” and the independent variables were identified as current “**technology education**” and **general education**

classes being taught in the middle school. The other possible variables were the genetic traits possessed by the research population.

INSTRUMENT DESIGN

The instrument design chosen for this research was the Wiesen Test for Mechanical Aptitude (**Appendix A**). Wiesen (1999) defined mechanical aptitude as “the ability to learn about mechanical objects and physical and mechanical principles in both an implicit and explicit fashion.” Wiesen (1999) believed that mechanical aptitude could therefore be measured by how familiar a person was with “common physical objects, tools, devices, in relation to their function, use and repair, and size/shape/weight/appearance.” The test itself contained sixty multiple-choice questions that addressed the concept of mechanical aptitude. It was designed for completion within a thirty-minute time period. The test package included a manual, reusable test booklets, standard answer sheets, and ready-made test scoring keys. The instructions were fairly simple to follow and the questions appeared clear and straightforward. This test was written so it could be understood by persons who had obtained a sixth grade and above reading level. The test was designed to gather the information needed to support the hypothesis of this study. **Appendix A** is an actual test booklet containing the sixty-question Wiesen Test of Mechanical Aptitude, used on both control and experimental populations during this study.

ADMINISTRATION OF THE INSTRUMENT

The test was administered to a total of one hundred Students from Northside Middle School in Norfolk, Virginia, combined from the sixth and seventh grades. There were no eighth graders included in either the control or the experimental groups due to the time

periods allocated for the testing. The test was taken in a controlled environment, with two monitors present at all times. All testing materials were prepared and checked satisfactory before the test. The testing environment was favorable, the rules and test examples were explained prior to taking the test.

The purpose of the test was explained prior to each setting and all participants seemed willing to participate. An answer sheet, a test booklet and a pencil were distributed to each participant.

There was adequate space between participants and seating arrangements were made to help avoid possible cheating. All participants were given thirty minutes to complete the test. Upon completion, the answer sheets and test booklets were collected from each participant and test security was maintained at all times. The answer sheets were maintained separate in their specific groups. They were hand-scored and recorded by this researcher at a different time/place.

METHODS OF DATA COLLECTION

Official permission was requested and granted from the school administration for the purpose of data collection. A cover letter (**Appendix B**) was sent to the Principal and Technology Education Teacher requesting a population for testing. The participants were identified and time slots were allotted for the testing. The tests were given to the applicable teachers for administration to the control and experimental groups of students at Northside Middle School, Norfolk, Virginia, and observed by this researcher during the testing process. The test results were collected and scored by this researcher. The data obtained was compiled and tabulated for the purpose of analysis.

STATISTICAL ANALYSIS

The data collected during this study was used to determine percentile ranking, the mean and the standard deviation. A t-test was employed to determine if there was a significant difference between the two populations in their abilities to solve mechanical problems.

SUMMARY

Chapter III discussed the methods and procedures utilized for collecting and analyzing data necessary for completing this study. The population was identified as students obtained from sixth and seventh grades, attending Northside Middle School. Research variables were identified, and the testing instrument was identified as the Wiesen Test for Mechanical Aptitude. Method of data collection and statistical analysis were also discussed this chapter.

CHAPTER IV

FINDINGS

In this chapter the findings of the Wiesen Test of Mechanical Aptitude administered to the sixth and seventh grade students at Northside Middle School in Norfolk, Virginia, were reported. This chapter contained the following sub-sections: Problem of the Study and Instrument Used, Report of the Findings, Overview of Responses, and Summary.

PROBLEM OF THE STUDY AND INSTRUMENT USED

The problem of this study was to determine if participating in technology education classes improved the mechanical aptitude of middle school students. The instrument used to obtain data was the Wiesen Test of Mechanical Aptitude. This test consisted of sixty multiple-choice questions to be answered in a thirty-minute time period.

REPORT OF THE FINDINGS

The data collected from this study was compiled into Tables 1 through 4 and Figure 1. Table 1 is a list of the raw data compiled from applying the Wiesen Test of Mechanical Aptitude Test to the control group. Table 2 is a list of raw data compiled from applying the Wiesen Test of Mechanical Aptitude Test to the experimental group. Figure 1 is a graph of the test scores of both groups compared with each other. The material included on Table 3 contained the percentile ranking, standard deviation, mean, median and mode of both populations compared with each other. Table 4 contains the results of a t-test analysis for the study.

OVERVIEW OF RESPONSES

The control group consisted of fifty students taken from three separate Band classes. Twenty-three of these subjects were male and twenty-seven were female. Nineteen of these subjects came from the sixth grade and the other thirty-one came from the seventh grade. The highest grade recorded from this sample was fifty-two out of a possible sixty points, clearly an indication of the highest level of mechanical aptitude demonstrated by a subject from this entire population. This was obtained from a male sixth grader.

The lowest grade obtained in this group was twenty-eight, and it was obtained by a male sixth grader. Of this sample twenty-eight of the subjects were Caucasian, seventeen were African American, four were Asian, and one was Hispanic.

The experimental group consisted of fifty students taken from three separate Technology Education classes. Of the fifty subjects, twenty-five of these were female and twenty-five were male. Nineteen of these subjects came from the sixth grade and the other thirty-one came from the seventh grade. The highest grade obtained in this group was forty-six out of a possible sixty points, obtained from a female seventh grader. The lowest grade recorded from this group was twenty points, clearly an indication of the lowest level of mechanical aptitude demonstrated by a subject from this entire population. Two male subjects obtained this grade from this group, one from the sixth grade and the other from the seventh grade. Of this sample, twenty-five were African

Raw Data from Wiesen Test Of Mechanical Aptitude

Control Group

Score	Grade	Sex	Ethnicity	Score	Grade	Sex	Ethnicity
52	6	male	Caucasian	39	7	Female	Black
47	7	Male	Hispanic	38	6	Female	Caucasian
46	7	Female	Asian	38	7	Female	Caucasian
45	7	Female	Caucasian	37	7	Female	Caucasian
45	7	Male	Caucasian	37	7	Female	Asian
44	7	Female	Caucasian	37	7	Female	Caucasian
44	6	Male	Caucasian	37	6	Female	Black/Cau
43	6	Male	Caucasian	37	6	Male	Caucasian
43	6	Male	Black	37	7	Female	Caucasian
43	7	Male	Caucasian	36	6	Male	Caucasian
43	7	Male	Asian	36	6	Female	Black
42	7	Male	Caucasian	36	6	Male	Black
42	7	Male	Black	36	7	Female	Black/Indian
42	6	Female	Caucasian	35	7	Female	Caucasian
42	7	Female	Caucasian	35	7	Female	Caucasian
41	7	Female	Asian	34	7	Male	Caucasian
41	7	Female	Caucasian	33	7	Female	Caucasian
41	7	Female	Black	33	7	Male	Caucasian
41	7	Female	Black	32	6	Male	Caucasian
40	7	Male	Caucasian	31	7	Female	Black
40	7	Male	Black	31	7	Female	Black
40	6	Male	Caucasian	30	7	Male	Black
40	7	Female	Black	30	6	Male	Black
39	7	Male	Caucasian	30	7	Female	Black
39	6	Female	Caucasian	28	6	Male	Black

Table 1

American, twelve were Caucasian, three were Hispanic, three were Native

American/Caucasian mixture, and the other seven were a mixture of several different races.

Raw Data from Wiesen Test Of Mechanical Aptitude

EXPERIMENTAL GROUP

Score	Grade	Sex	Ethnicity	Score	Grade	Sex	Ethnicity
46	7	Female	Caucasian	35	7	Female	Black/Indian
45	7	Male	Caucasian	35	7	Female	Caucasian
44	7	Male	Cau/NatAmerican	34	6	Female	Black
43	7	Male	Black	34	6	Male	Black
42	6	Male	Caucasian	34	7	Female	Black/Indian
41	6	Female	Black	33	7	Female	Caucasian
40	7	Female	Caucasian	33	6	Female	Nat. American
39	7	Female	Cau/Asian	33	7	Female	C/BL/A.Indian
39	7	Female	Black	32	7	Female	Black
39	7	Male	Hispanic	32	7	Male	Caucasian
39	6	Female	Caucasian	32	6	Female	Black
39	6	Male	Caucasian	31	6	Female	Black
39	7	Female	Hispanic	31	7	Female	Black
39	7	Female	Caucasian	30	7	Male	Black
38	7	Male	Cau/NatAmerican	30	7	Male	Black
38	6	Male	Black	29	6	Male	Hispanic
38	6	Male	Black	29	6	Male	Black
38	7	Female	Asian	28	8	Female	Black/W.Indian
38	7	Female	Caucasian	27	7	Male	Cau/NatAmerican
38	7	Female	Black	25	6	Male	Black
37	7	Male	Black	25	6	Male	Black
37	7	Male	Black	25	6	Male	Black
37	7	Female	Caucasian	22	7	Male	Black
36	6	Male	Black	20	6	Male	Caucasian
35	6	Female	Black	20	7	Male	Black

Table 2

Figure 1 presents a comparison of the test scores of Mechanical Aptitude demonstrated by both the control and the experimental groups. It visualizes the number of participants per group and their individual scores in rank order. The scores from the control group were generally higher than those of the experimental group.

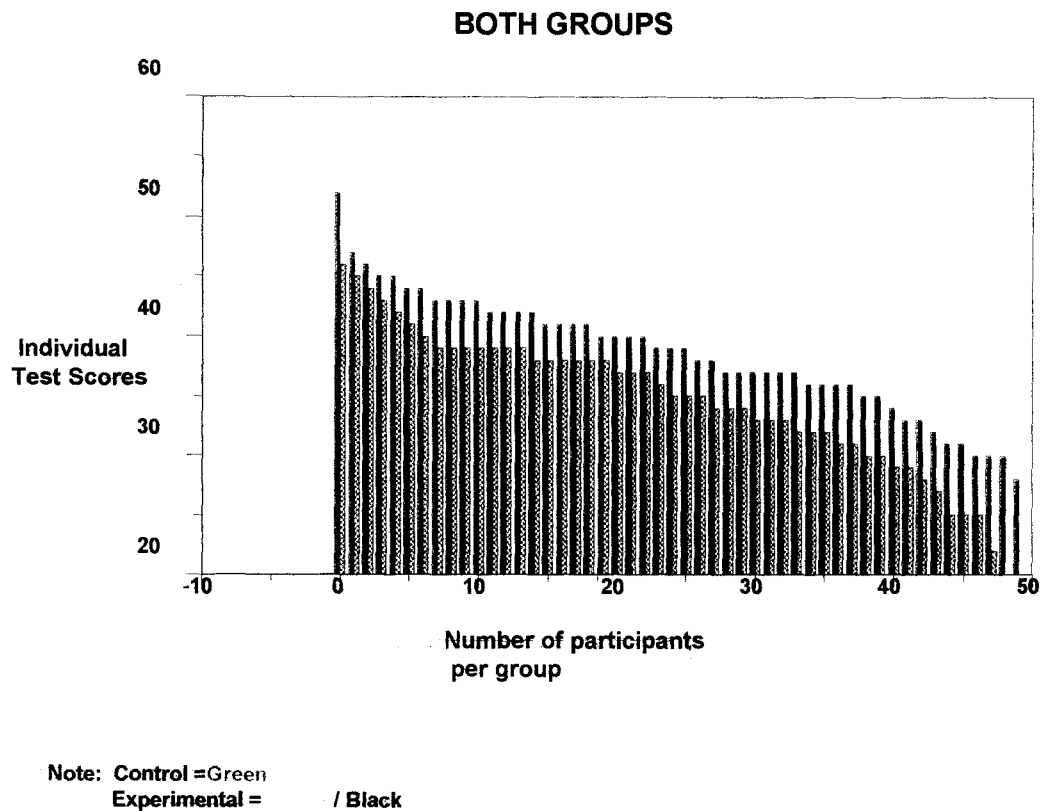


Figure 1

Table 3 contained descriptive data compiled from both groups of participants. In both the control and experimental groups, ten subjects from each group were in the tenth percentile ranking and below. Fourteen subjects from the control and thirteen subjects from the experimental groups were in the twenty-fifth percentile ranking. In the fiftieth percentile rank, eleven subjects came from the control group, while thirteen came from the experimental group. In the seventy-fifth percentile, eight subjects came from the control group and eight subjects also came from the experimental group. In the ninetieth percentile, seven subjects came from the control group and six subjects came from the experimental group.

For the purpose of this study, only twenty-six subjects from the control group and 14 subjects from the experimental group achieved the sixty-fifth percentile ranking and above. In the control group, the mean score was 38.56 points, the median score was 39.0 and the mode was 39.88 points each. For the experimental group the mean score was 34.46 points, the median score was 35.0 points and the mode was 36.08 points.

Statistical Report

	Control	Subjects	Experiment	Subjects
Sample size (N)	50		50	
Minimum	28.0000		20.0000	
Maximum	52.0000		46.0000	
Std deviation	5.0433		6.1750	
Variance	25.4351		38.1310	
Std error	0.7132		0.8733	
Mean	38.5600		34.4600	
Sum	1928.00		1723.00	
Sum squares	75590.0		61243.00	
Median	39.0000		35.0000	
Mode	39.8800		36.0800	
Skewness	0.0092		-0.5231	
Coeff skewness	0.0046		-0.2616	
Percentiles:				
10th	31.0000	10	25.0000	10
25th	35.7500	14	30.7500	13
50th	39.0000	11	35.0000	13
75th	42.0000	8	39.0000	8
90th	44.9000	7	41.9000	6
95.00% Confidence Interval:				
Lower limit	37.1267		32.7051	
Upper limit	39.9933		36.2149	

Table 3

A t-test was completed to determine if there was a significant difference between the sample means of the control and experimental groups. The results of the t-test were .55 and are recorded in Table 4. A one tailed test was conducted because there was a

prediction made in the form of a hypothesis. The degrees of freedom for this test equaled 98, which yielded a pre-determined critical value of **1.65** at the **.05 level of significance** and a value of **2.374** at the **.01 level of significance**.

t-test Analysis Results

Confidence Level = 0.95 [One Tail Test]

Control vs. Experiment:

	Control	Experiment	
Sample Size	50	50	
Mean	38.560	34.460	Difference = 4.1
Variance	25.4351	38.1310	Ratio = 0.6670
T-Value Probability			DF
General			98
			Critical t-Value
			.55

Table 4

SUMMARY

In this chapter, the results of the test scores obtained from applying the Wiesen Test of Mechanical Aptitude were recorded and examined. The problem of this study was to determine if participating in technology education classes improved the mechanical aptitude of students at Northside Middle School, Norfolk, Virginia. The results of the test were reported in Tables 1 - 4 and Figure 1. A t-test was conducted to determine if there was a significant difference between the groups. When the results of both groups were compiled, the control group scores were higher than those of the experimental group. Chapter V will provide the Summary, Conclusions and Recommendations for the study.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The problem of this study was to determine if participating in technology education classes improved the mechanical aptitude of middle school students. The hypothesis of this study was “ Students taking technology education classes at Northside Middle School in Norfolk, Virginia, developed higher levels of mechanical aptitude when compared to students from the same school who took only the traditional general education classes.”

The control group of students was taken from three music classes and the experimental group was taken from three technology education classes at Northside Middle School. The Wiesen Test of Mechanical Aptitude Test was the instrument for determining the effects of taking technology education. The test was administered to both groups of students near the end of the school year, so the experimental group had a chance to partake in technology education. The control group did not participate in technology education classes.

The results of the test were scored and recorded. The data from both groups were tabulated and a t-test was used to determine if there was a significant difference between the control and the experimental group.

CONCLUSIONS

The findings of the study were analyzed and compared to the purpose and hypothesis stated at the beginning of this study. This researcher's hypothesis was:

H₁: Students taking technology education classes at Northside Middle School, Norfolk, Virginia, developed higher levels of mechanical aptitude when compared to students from the same school that take only the traditional education classes.

The results of the t-test performed by this researcher noted a critical t-ratio of 1.65 at the .05 level of significance. With a t-test result of .55, this researcher had to reject the hypothesis. In conclusion, it was determined that taking technology education classes did not develop higher mechanical aptitude levels for students. In fact, the overall scores of the control group were higher than those of the experimental group. An examination of the students from each group sampled revealed that the students from the control group were better stratified than the students from the experimental group, possibly accounting for some of the higher scores. Furthermore, it is generally believed in academic circles that students who enroll in band/orchestra classes tend to perform better academically than other students in the school.

Technology education classes are considered to be elective classes, sometimes less desirable than other academic classes. This researcher also believes that technology education classrooms tend to be filled by students who are considered to be "difficult" by other teachers; students who are not presently planning to attend college or unsure of their future; students who might be having difficulties with their academic performance in regular classes; plus students the guidance counselors believe would be better served in technology education.

RECOMMENDATIONS

Additional studies and research are recommended in the area of mechanical aptitude and technology education. Although the data did not show a significant difference between the two variables, different testing methods could be employed for gathering data in the future. This researcher recommends identifying the samples at the beginning of the school year, and modifying the sampling process for each group in order to obtain a randomly stratified sample for each group. The participants from both groups must be given a pre-test at the start of school and their grade point averages must be recorded for comparison to test results. The treatment must then be applied to the experimental group during the school year. A post-test must be given to both groups at the end of the school year and grade point averages again recorded.

The Wiesen Test of Mechanical Aptitude appeared to be an easy test to administer. The majority of the students replied when asked, that the test was easily understood. This could imply that the age group previously recommended for taking this test could be lowered. Most of the subjects taking the test completed it well within the thirty-minute period allowed. In fact, most participants completed their test within fifteen to twenty minutes. This researcher recommends the Wiesen Test of Mechanical Aptitude for widespread use in the school system, middle school and above, for determining mechanical aptitude. A substantial increase in scores for the experimental group at the end of the school year could be highly indicative of the ability of technology education classes to increase Mechanical Aptitude.

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APPENDIX A.

Wiesen Test of Mechanical Aptitude

WTMA™

Wiesen Test of Mechanical Aptitude™

PAR Edition

Joel P. Wiesen, PhD

Instructions

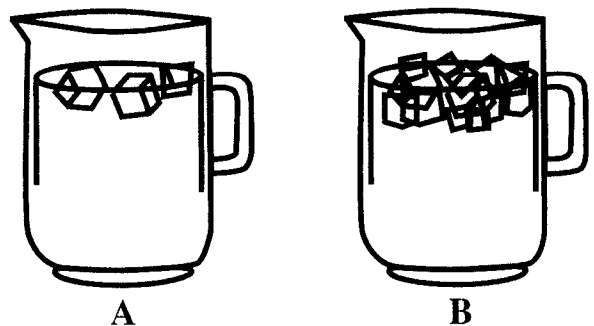
1. **DO NOT WRITE IN THIS BOOKLET.**
2. Mark all your answers on the answer sheet. Use a Number 2 pencil only. If you want to change an answer, erase the old answer completely.
3. Choose the one best answer for each question.
4. You should try to answer all 60 questions. You will not lose credit for wrong answers. You will have 30 minutes to complete the test.
5. You may reread any part of this booklet while you are taking the test. If you finish early, check your answer sheet to make sure that you have answered all the questions.

Look at the sample question on this page. Then mark your answer on the answer sheet by filling in the circle with the letter of that answer in the "Sample Question" box. Answer the sample question now.

Sample Question

Which pitcher of water will stay cold longer?

- (A) A
- (B) B
- (C) There is no difference.



The correct answer for the sample question is B. For every question, there is always one clear difference between drawings A and B.

— Do not open this booklet until you are told to do so. —

PAR Psychological Assessment Resources, Inc./P.O. Box 998/Odessa, FL 33556/Toll-Free 1.800.331.TEST/www.parinc.com

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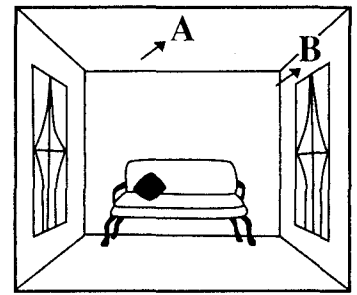
9 8 7 6 5 4 3 2 1

Reorder #RO-4259

Printed in the U.S.A.

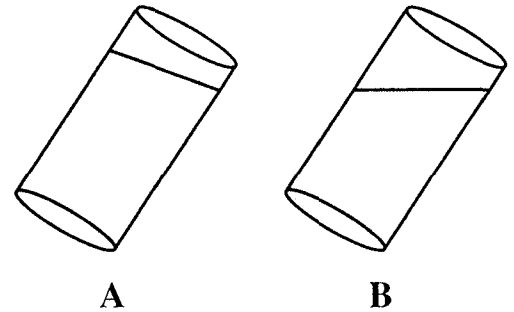
1. Which is the better place to put a smoke detector?

- (A) A
- (B) B
- (C) There is no difference.



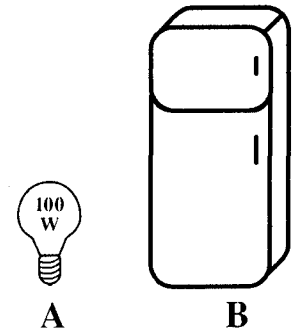
2. If you tilt a glass of water, what will happen to the water?

- (A) As shown in picture A
- (B) As shown in picture B
- (C) Can't tell.



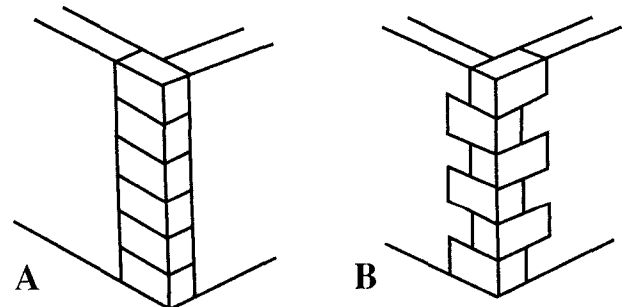
3. When turned on, which uses more electricity, the light bulb or the refrigerator?

- (A) A
- (B) B
- (C) There is no difference.



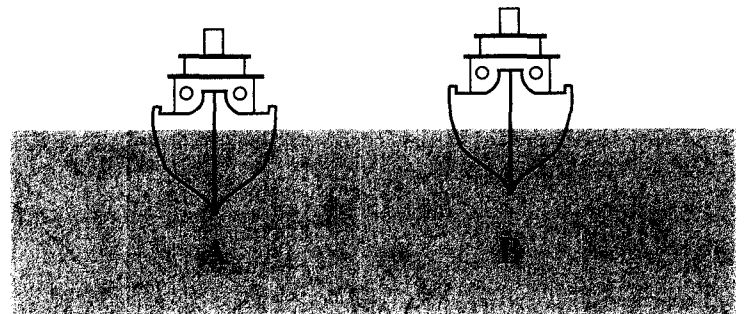
4. Look at this drawing of the corners of two buildings. Which building is stronger?

- (A) A
- (B) B
- (C) There is no difference.



5. Look at this drawing of two boats. Which boat is heavier?

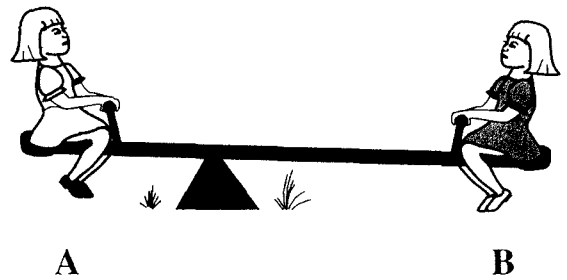
- (A) A
- (B) B
- (C) There is no difference.



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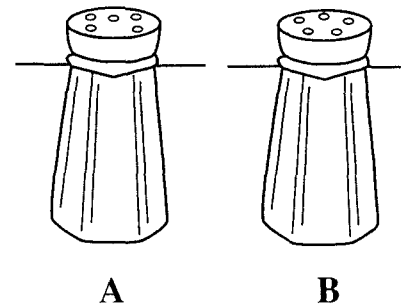
6. Which girl weighs more?

- (A) A
- (B) B
- (C) There is no difference.



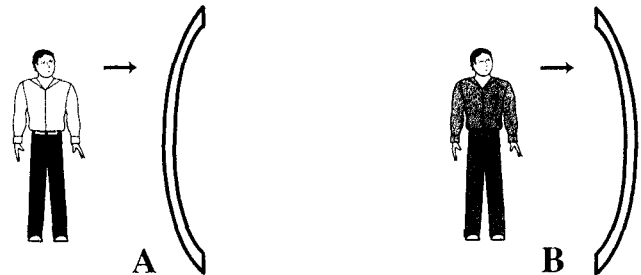
7. Both salt shakers are half full of salt. Which shaker will pour faster?

- (A) A
- (B) B
- (C) There is no difference.



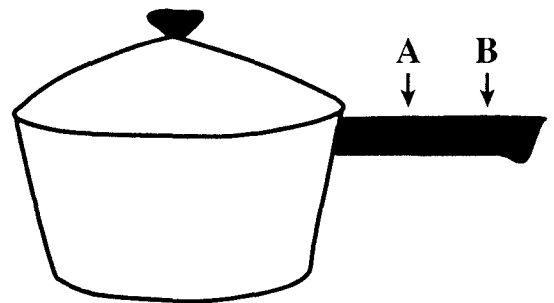
8. Which mirror would make you look larger?

- (A) A
- (B) B
- (C) There is no difference.



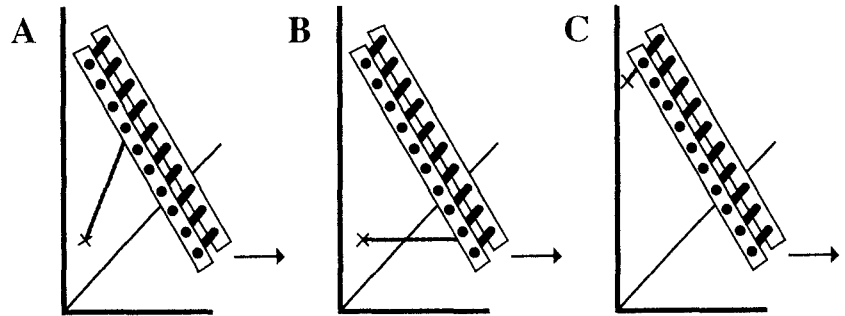
9. Where would you hold the handle to carry a heavy pot more easily?

- (A) A
- (B) B
- (C) There is no difference.



10. Each drawing shows a ladder leaning against a wall. Each ladder is tied to the wall with a rope. Which ladder is least likely to slip in the direction of the arrow?

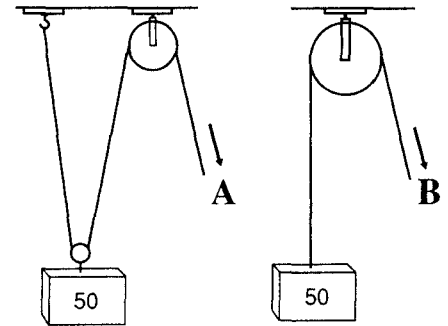
- (A) A
- (B) B
- (C) C



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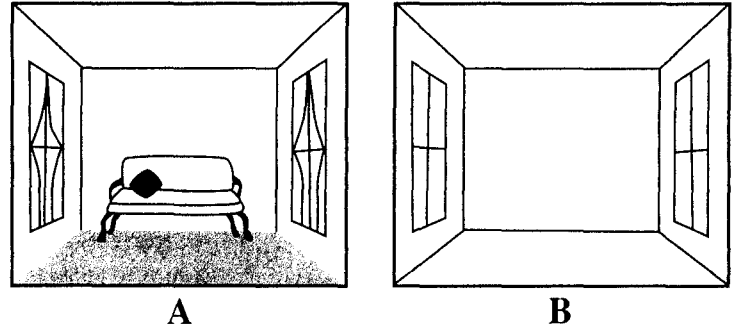
11. If someone pulls on the rope in the direction indicated, which weight will be easier to lift?

- (A) A
- (B) B
- (C) There is no difference



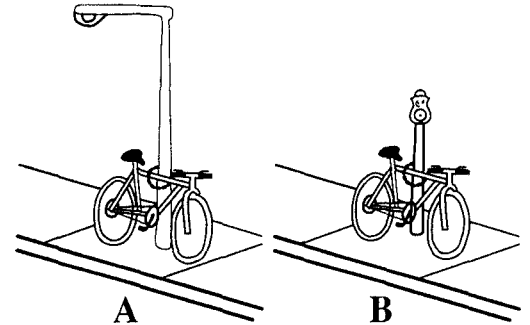
12. Here are two rooms: room A with a carpeted floor, and room B with a bare wood floor. In which room is a person more likely to get shocked by static electricity?

- (A) A
- (B) B
- (C) There is no difference.



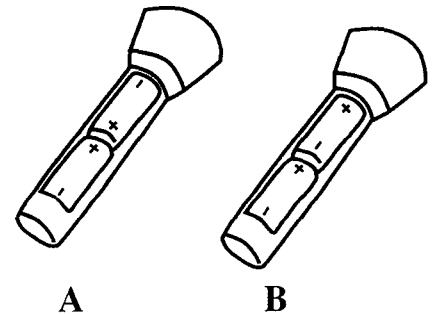
13. Both bicycles are chained to a pole. Which bicycle is less likely to be stolen?

- (A) A
- (B) B
- (C) There is no difference.



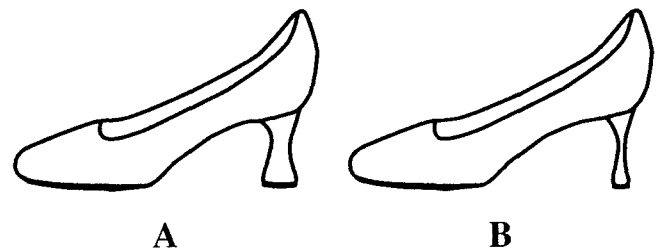
14. Which way will the flashlight work better?

- (A) A
- (B) B
- (C) There is no difference.



15. These heels are the same height. Which shoe is easier to walk in?

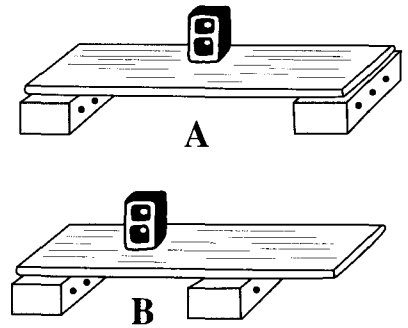
- (A) A
- (B) B
- (C) There is no difference.



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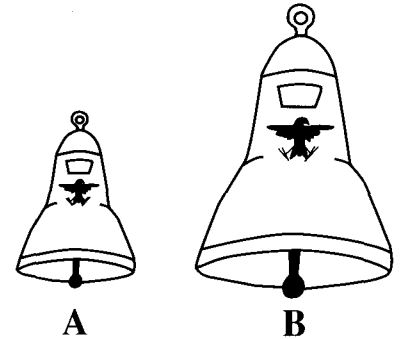
16. These two shelves are identical. Which will support a heavier block on top without breaking?

- (A) A
- (B) B
- (C) There is no difference.



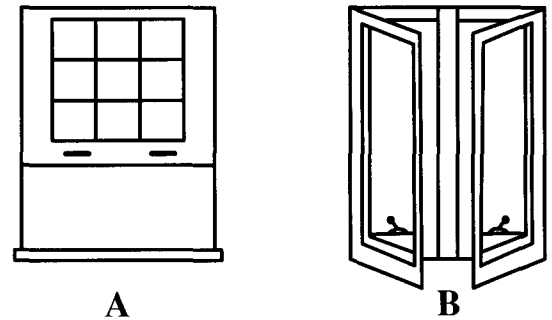
17. Which bell will have a higher pitched tone?

- (A) A
- (B) B
- (C) There is no difference.



18. The room is hot. Which open window would cool the room faster?

- (A) A
- (B) B
- (C) There is no difference.



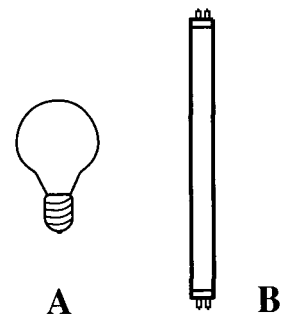
19. There is a rope holding a piece of wood underwater. If the rope is cut, will the water level in the container go up or down?

- (A) Down
- (B) Up
- (C) It will not change.



20. Which type of light bulb usually lasts longer before burning out?

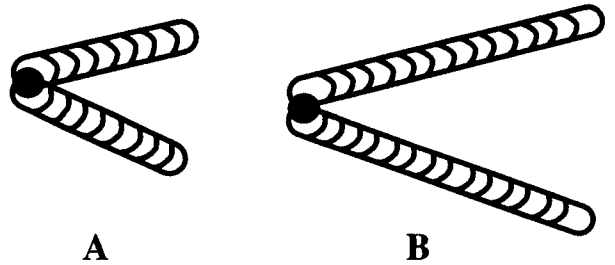
- (A) A
- (B) B
- (C) There is no difference.



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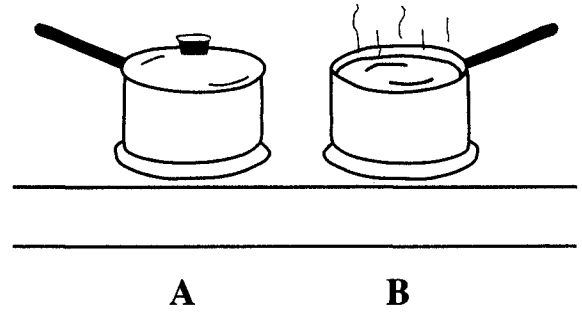
21. Which nut cracker needs more strength to use?

- (A) A
- (B) B
- (C) There is no difference.



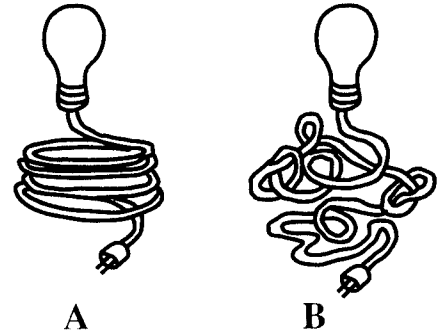
22. These pots are the same size, hold the same amount of cold water, and are cooking at the same heat. Which pot will come to a boil faster?

- (A) A
- (B) B
- (C) There is no difference.



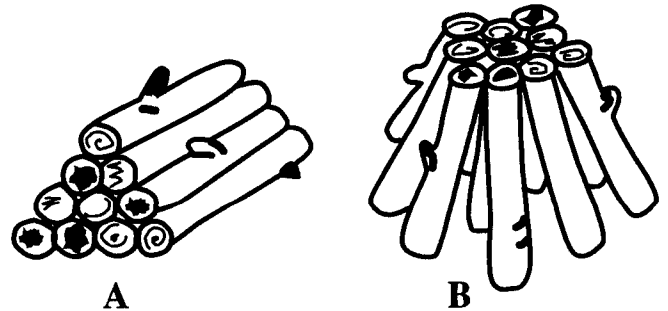
23. These two bulbs and cords are the same. When they are plugged in, which light bulb will look brighter?

- (A) A
- (B) B
- (C) There is no difference.



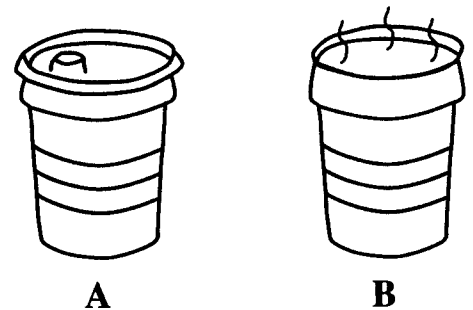
24. If these two piles of logs both catch on fire, which pile will burn faster?

- (A) A
- (B) B
- (C) There is no difference.



25. You just poured hot coffee into these two cups. You covered one of the cups with a lid. Which cup of coffee will stay hot longer?

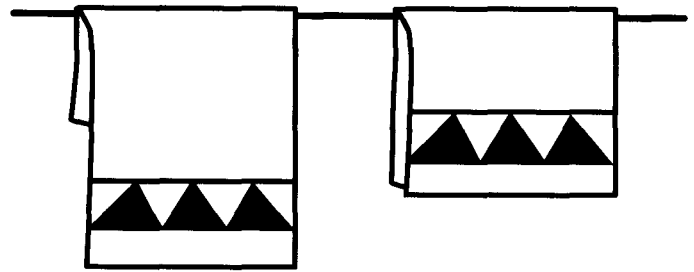
- (A) Covered
- (B) Uncovered
- (C) There is no difference.



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26. Two towels are hanging on a clothes line.
Which is more likely to slip off?

- (A) A
- (B) B
- (C) There is no difference.



A

B

27. Which knife would let you cut up a 10 pound piece of raw meat more easily?

- (A) 9 inch knife
- (B) 6 inch knife
- (C) There is no difference.



A



B

28. Which handbag is less likely to open when it is carried?

- (A) A
- (B) B
- (C) There is no difference.



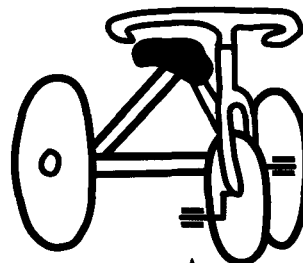
A



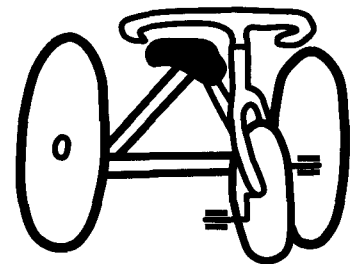
B

29. Which can go faster?

- (A) A
- (B) B
- (C) There is no difference.



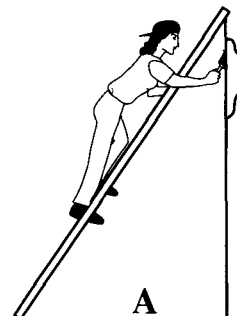
A



B

30. These pictures show different ways of standing on a ladder and painting a wall.
Which ladder is more likely to fall?

- (A) A
- (B) B
- (C) There is no difference.



A

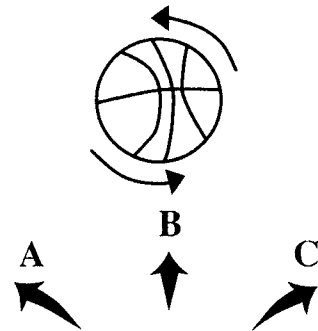


B

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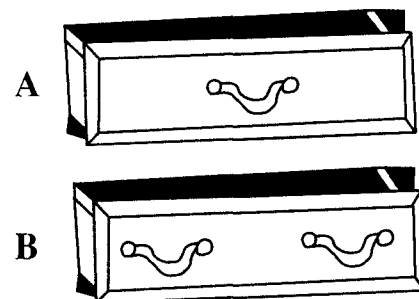
31. This basketball is falling straight down and spinning in the direction shown by the arrows. Which way will the ball bounce when it hits the ground?

- (A) Toward the left
- (B) Straight up
- (C) Toward the right



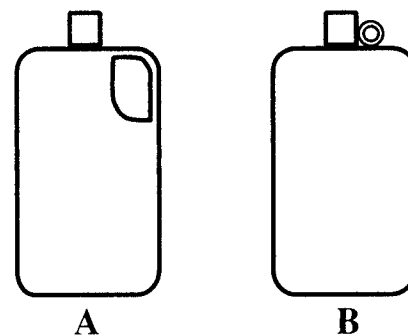
32. Which drawer is easier to open using one hand?

- (A) A
- (B) B
- (C) There is no difference.



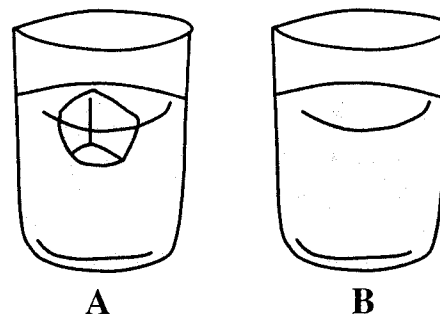
33. From which one gallon jug is it easier to pour?

- (A) A
- (B) B
- (C) There is no difference.



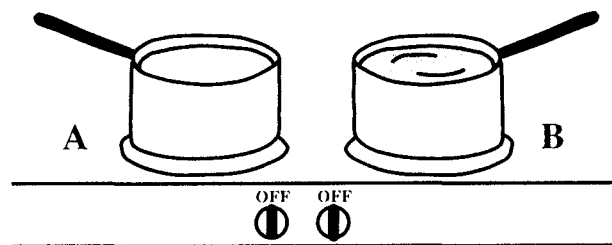
34. Cup A has water and an ice cube in it. Cup B is the same glass of water only the ice cube has melted. As a result of the ice melting what is the difference in weight between Cup A and Cup B?

- (A) Cup B is heavier.
- (B) Cup B is lighter.
- (C) There is no difference.



35. One of these pots is empty; the other is full of water. Which is less likely to tip over if someone bumps the handle?

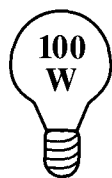
- (A) Empty
- (B) Full
- (C) There is no difference.



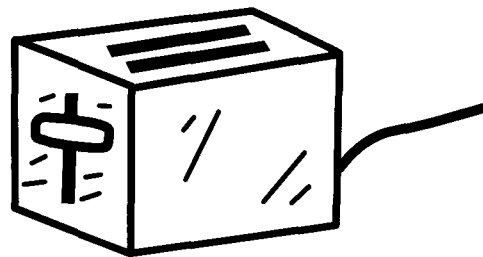
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36. When turned on, which uses more electricity, the light bulb or the toaster?

- (A) A
- (B) B
- (C) There is no difference.



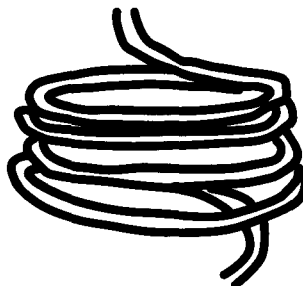
A



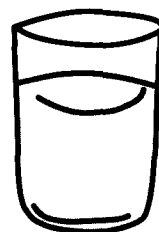
B

37. Which is a better conductor of electricity, metal or water?

- (A) A
- (B) B
- (C) There is no difference.



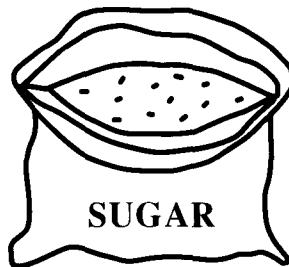
A



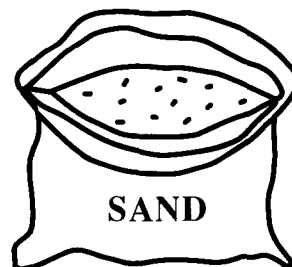
B

38. Which is better to use to put out a fire?

- (A) A
- (B) B
- (C) There is no difference.



A



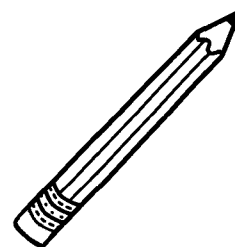
B

39. Which is easier to break?

- (A) Crayon
- (B) Pencil
- (C) There is no difference.



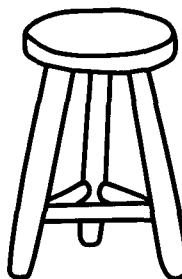
A



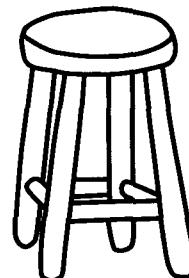
B

40. Which is more likely to wobble?

- (A) A
- (B) B
- (C) There is no difference.



A

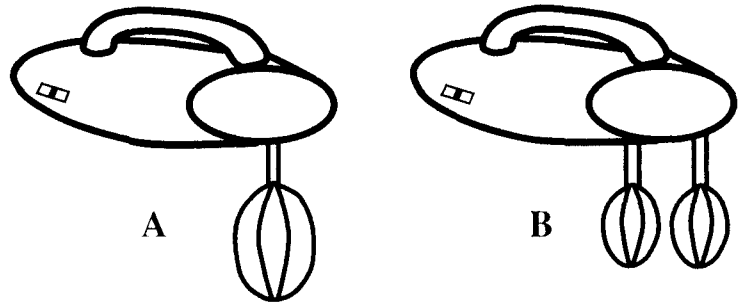


B

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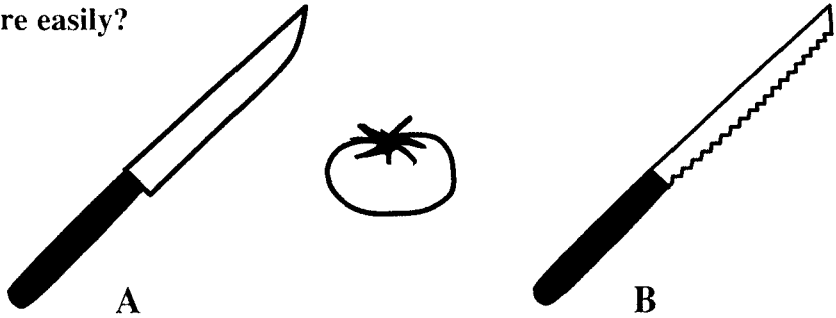
41. Which kitchen mixer will do a better job of mixing?

- (A) A
- (B) B
- (C) There is no difference.



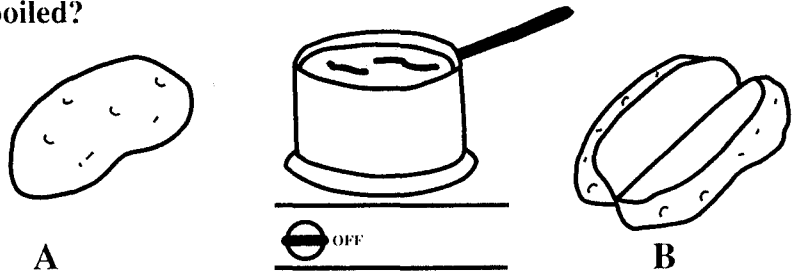
42. Which knife can cut a tomato more easily?

- (A) A
- (B) B
- (C) There is no difference.



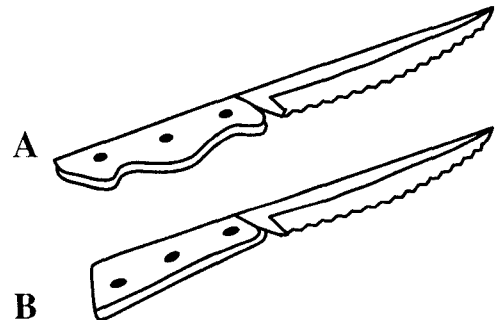
43. Which potato will cook faster when boiled?

- (A) A
- (B) B
- (C) There is no difference.



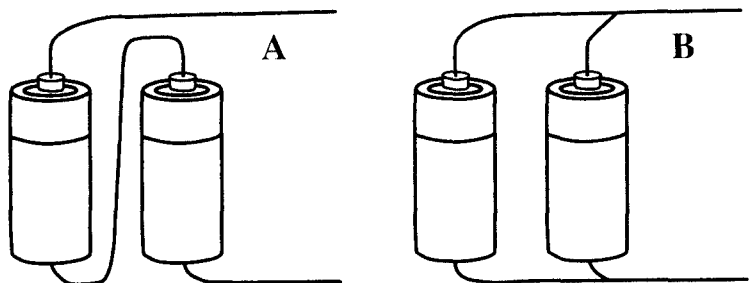
44. Which steak knife is safer to use?

- (A) A
- (B) B
- (C) There is no difference.



45. Which set of batteries will give the higher voltage?

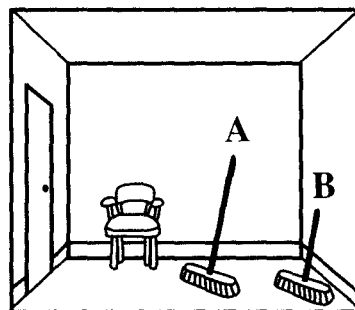
- (A) A
- (B) B
- (C) There is no difference.



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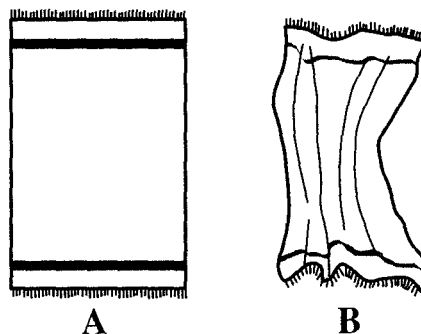
46. Which broom is easier to use?

- (A) A
- (B) B
- (C) There is no difference?



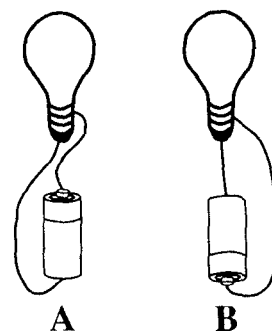
47. Which way will a wet towel dry faster?

- (A) A
- (B) B
- (C) There is no difference.



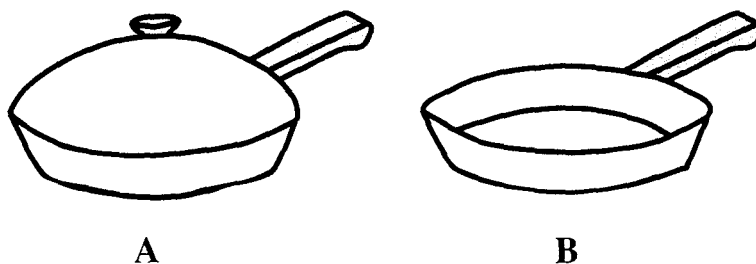
48. Which way will light up the light bulb brighter?

- (A) A
- (B) B
- (C) There is no difference.



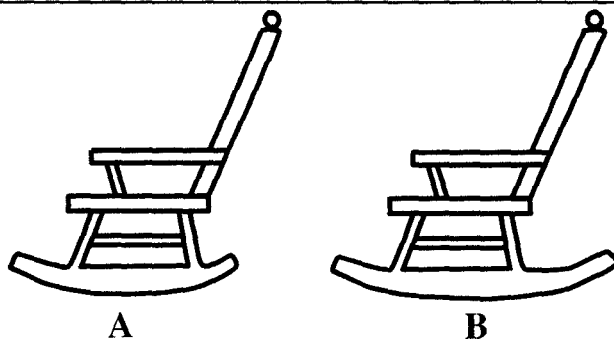
49. Which way will fry the food crisper?

- (A) A
- (B) B
- (C) There is no difference.



50. Which rocking chair is safer to use?

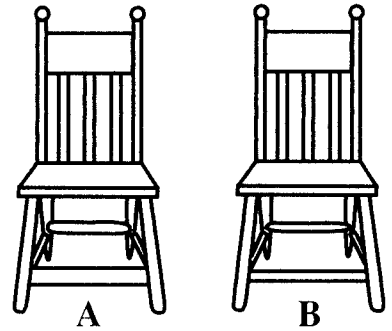
- (A) A
- (B) B
- (C) There is no difference.



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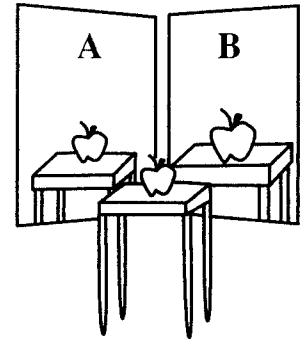
51. Which chair will hold a heavier person?

- (A) A
- (B) B
- (C) There is no difference.



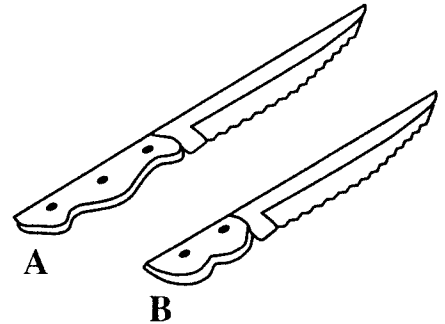
52. A and B are mirrors. Which mirror is flat?

- (A) A
- (B) B
- (C) There is no difference.



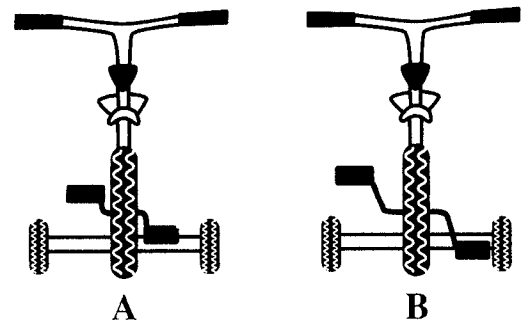
53. Which steak knife is safer to use?

- (A) A
- (B) B
- (C) There is no difference.



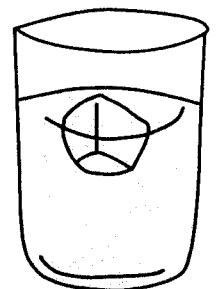
54. Which tricycle is easier to ride uphill?

- (A) A
- (B) B
- (C) There is no difference.



55. You have a glass of water with an ice cube in it. The ice cube melts. What will happen to the level of the water in the glass?

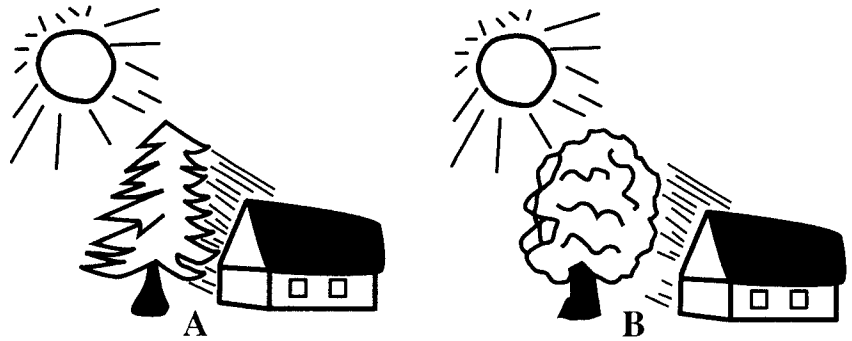
- (A) Go up
- (B) Go down
- (C) Remain the same.



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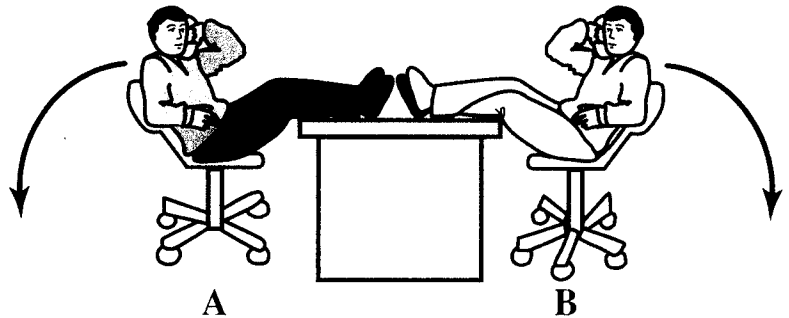
56. Which house will get more sun in the winter?

- (A) A
- (B) B
- (C) There is no difference.



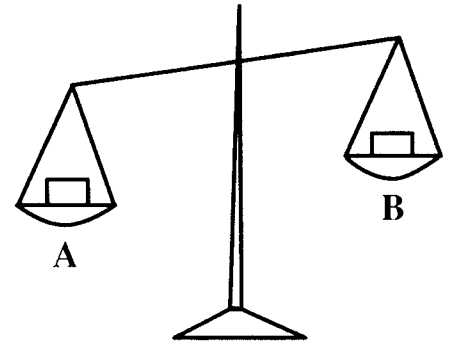
57. Which chair will let the man lean back more without falling?

- (A) A
- (B) B
- (C) There is no difference.



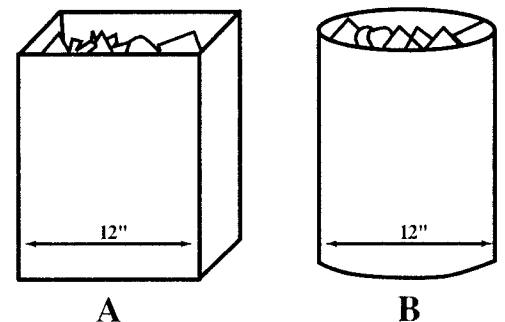
58. This scale is not balanced. On which side do you need to add weight in order to make it balance?

- (A) A
- (B) B
- (C) It will balance if you add weight to either side.



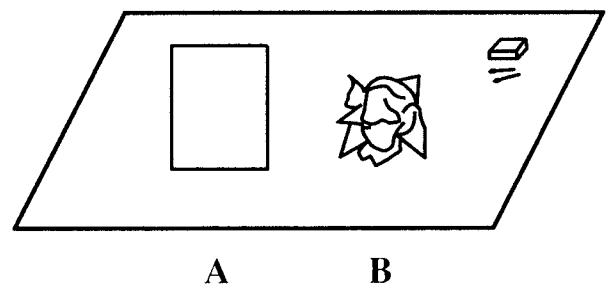
59. These two garbage cans are the same height and both are 12 inches wide, but one of them is square and one is round. Which one holds more trash?

- (A) A
- (B) B
- (C) There is no difference.



60. On this table top are two pieces of paper which are exactly the same, except one is crumpled up. If you light both with matches, which piece of paper will burn faster?

- (A) A
- (B) B
- (C) There is no difference.



End of Test **STOP**

APPENDIX B.

Cover Letter to Teacher

April 27, 2000

Dear Mr. Dunn

I am currently a Masters degree candidate in the College of Education's Occupation and Technical Educational studies at Old Dominion University, working with Dr. John Ritz on a project dealing with Technology Education in Middle Schools and mechanical aptitude. The purpose of this study is to determine if participating in technology education classes improved mechanical aptitude of middle school students. Currently, there is no testing being accomplished on the outcome or validity of technology education classes being taught in Middle Schools. Success in this study could provide an acceptable instrument for testing the outcome of technology education instruction, predicting student aptitude for particular job occupations as well as a measurement of mechanical aptitude.

I am asking if you could have your technology education teacher (experimental group) and another general education teacher (control group) each administer the enclosed test instrument to fifty of their students during the first week of June 2000, or within the last two weeks of school. I will provide each student with all the necessary materials needed (questionnaires, answer sheets and pencils). I will also be available for administering the testing instrument with your teachers' supervision.

The testing instrument contains 60 questions, to be completed in a 30 minute time period. The testing population can be made from a combination of sixth, seventh and eighth grade students. It is important to note that students from the **"control group" must not have taken** technology education classes in the past.

The names of your students who take the test will not be identified. I will use an alpha/numerical coding to label, process and identify my data. The privacy of all involved will be assured, and under no circumstances will I reveal the participants of this study to school administration or general public.

I deeply appreciate your cooperation and support, as well as the cooperation and support of your students and teachers. I would not be able to conduct this research project and shed some light on the outcome of technology education. When this study is completed, I will provide you with a full description of the results.
If you have further questions, please call me at 683-4305(W), or 498-9203 (H).

Sincerely

Amos C. Peterson